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(54) Title: A METHOD OF MANUFACTURING A CARRIER SUBSTRATE FOR CV FLOORING, A CARRIER SUBSTRATE FOR CV FLOORING AND CV FLOORING

(57) Abstract: The present invention relates to the carrier substrate for a PVC flooring, to the method of manufacturing said carrier substrate and to the PVC flooring. The PVC flooring is also usually known as CV (cushion vinyl) flooring. More particularly, the present invention relates to the production of a glass fiber carrier substrate, which incorporates a novel barrier layer, said barrier layer being formed of a pigment coating (22) coated on one face of said fibrous substrate (20a).



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A METHOD OF MANUFACTURING A CARRIER SUBSTRATE FOR CV FLOORING, A CARRIER SUBSTRATE FOR CV FLOORING AND CV FLOORING

(001) The present invention relates to a method of manufacturing a carrier substrate for CV flooring, to a carrier substrate for CV flooring and to CV flooring. The CV (cushion vinyl) flooring is in most cases also known as PVC flooring. More particularly, the present invention relates to the production of a carrier substrate made of mainly glass fiber and incorporating a novel barrier layer.

(002) PVC flooring and its manufacture have been discussed in more detail in, for instance, GB 1,029,085. The PVC flooring material according to the GB document comprises a substrate or a carrier substrate, which consists of woven or non-woven fabrics or rubber-impregnated paper. Woven fabrics are made of natural or synthetic fibres e.g. viscose, cotton, or hessian. Non-woven fabrics are made of synthetic or natural fibres e.g. viscose fibres bonded with polyvinyl alcohol, polyvinyl acetate or synthetic rubbers. The carrier material gives both strength and dimensional stability to the PVC flooring. Manufacturers produce most PVC floors by a process known as 'plastisol spread coating'. The PVC paste, or so-called plastisol is applied in several layers of vinyl resin paste so that the floor is literally 'built up'. Typically these include an impregnation layer, a foam core, a decorative layer, a clear protective wear layer and a foamed or compact back layer. The impregnation layer has a great importance to the final product quality as it forms a base for the other coating layers. The back layer, which is face downwards on the laying of the flooring material, is normally of greater thickness than the top layer giving cushioning properties to the flooring. Manufacturers can build up complex patterns and three-dimensional effects through these layers and offer choice of styles and effects. The end results are colourful, smooth and shiny surfaces. The preferred vinyl resin is polyvinyl chloride (PVC). The PVC plastisol paste may contain plasticisers e.g. diisononyl phthalate (DINP), di-(2-ethylhexyl)phthalate (DEHP), benzylbutyl phthalate (BBP) and diisooheptyl phthalate (DIHP), trixylenyl and tricresyl phosphates, stabilizers e.g. barium-cadmium soap, dibutyl tin dilaurate, dibasic lead carbonate, lead stearate, pigments, fillers e.g. CaCO_3 , viscosity depressants e.g. hexylene glycol, and solvents e.g. aliphatic mineral spirit. The coatings may be applied using conventional techniques e.g. spreading knife, roller coaters, screen coaters, hot melt coaters and extrusion coaters. Plastisols are rapidly fused so that the layers can be applied at a high production rate. Finally a pattern may be printed on the foam core layer after fusing. A polymerised vinyl resin

wear layer is provided on the printed layer, for example by coating with a vinyl resin paste. The wear layer may be transparent, coloured, mottled or have patterns embossed thereon. An additional polyurethane lacquer layer can be applied thereafter. Also other techniques like embossing and flake scattering are sometimes used to get special properties or effects to the final product.

(003) US 3,458,337 discusses the method of making covering materials incorporating foamed resin material and product thereof. A floor covering is disclosed where the base sheet is formed of an impregnated asbestos felt, a resin impregnated cellulose or other organic felt, or an asphalt saturated organic felt. A prime coat made of latex possibly including pigments or fillers is applied on the felt to, for instance, improve the adherence of vinyl type compositions to the felt. The document further teaches that the prime coat is laid on the felt separate from the felt manufacture, and on such a surface of the felt that is further provided with the various coating layers including a wear layer, i.e. on the upper side of the felt, not on the surface facing the floor.

(004) The manufacture of the PVC floorings has remained substantially the same for decades. The only remarkable change, which has taken place, is, that very often felt or veil or tissue made predominantly of glass fiber has replaced the various carrier materials discussed above. The glass fiber tissue may be produced by any known mat-forming technique, including, for instance, so-called dry-laid, or wet-laid methods. In the following the glass fiber products, which may be used in the manufacture of PVC floorings, will be discussed in more detail. The products are, for the most part made of glass fibers, whereby the remaining fibrous part of the products may be made of both natural and artificial fibers. Thus the following discussion covers all fibrous substrates consisting at least 50% glass fibers.

(005) Glass fibers are commonly produced by melting the glass raw materials and then fiberizing the molten liquid and applying a sizing chemical onto the filaments. The filaments so produced are cut to usable length. The fibers are typically deposited onto a moving, or sometimes stationary, support or collection surface to form a web of uniformly distributed fibers. The deposition of fibers may be performed by using any known method, such as, for instance, so-called air-laid, foam-laid or liquid-laid technologies. Liquid binder is applied on the fibers as they move along with the support or simultaneously with their spreading on the support. The glass fiber web is subsequently transported into an oven in which the binder is dried and set or cured.

Normally this is the product, so-called carrier substrate, which the PVC flooring, or CV flooring manufacturers buy from the glass fiber felt producers.

5 (006) The properties of the fibrous products produced in this manner are mainly based upon the properties of the glass fibers, and the compositions of the sizing and binder chemistry. It would at times be beneficial to modify the products in order to enhance certain properties and/or reduce costs.

10 (007) A major problem encountered in the manufacture of the PVC floorings is the costs involved in the use of PVC paste. This is especially true with regard to the carrier substrate, where compact paste is used whereas in the thick layers foam paste is most often used. Now that the carrier substrate is porous i.e. the interstices between the fibers are open all over the substrate, the PVC paste, when applied on one surface of the substrate, both saturates the entire substrate and tends to partially penetrate or permeate the substrate. This has been taken into account in prior art carrier substrates by adjusting the substrate thickness (means normally increasing the
15 thickness of the substrate to exceed other requirements set for the thickness of the carrier layer) so that the substrate is able to absorb substantially all the PVC paste introduced thereon. In fact, the thicker is the carrier substrate, the slower the paste flows therethrough. Yet, from the thickness point of view, as the impregnation layer is the most expensive one, its thickness should be as low as possible.

20 (008) Another problem relates to the permeation of PVC paste through the carrier substrate, i.e. the flow of the paste through the substrate. After permeation the PVC paste collects onto the backing roller, from where it may be removed by doctor means, and returned back to use. However, part of the paste remains on the opposing surface of the substrate, and gets into contact with rolls following the paste
25 application, whereby the roll surfaces get dirty. This can be avoided, for instance, by pre-gelling the paste with infrared lamps to dry the excess paste on the surface before the rolls. This kind of treatment may lead to uneven coating having variations in the thickness and surface quality of the coating. However, the penetration or permeation of the PVC paste is not a required feature, but proper and complete saturation of the
30 substrate is normally the goal. Yet, the present technique does not know a way the complete saturation could be ensured without allowing some of the paste to penetrate or permeate the substrate.

(009) As other problems encountered in the manufacture of PVC or CV floorings, the following could be mentioned

- surface quality of the final flooring product,
- the surface quality of the faces of the carrier substrate,
- possible defects in the manufacture of the carrier substrate,
- yellowing of the carrier substrate, as, by nature, the binders tend to yellow in the drying phase of the substrate

(0010) Accordingly, an object of the present invention is to provide an improved carrier substrate for the manufacture of PVC or CV flooring. The improvements include, for instance,

- lowered material costs
 - as the penetration or permeation of the PVC paste decreases,
 - as thinner carrier substrate may be used, which, as a result, also lowers the amount of PVC paste required for the saturation of the substrate,
- the defects in the manufacture of the carrier substrate can be easily covered,
- loose or upsticking fibers can be covered,
- the smoothness of the surfaces of the end product is improved as a result of even and controlled PVC paste penetration,
- upper surface of the tissue can be left open to absorb PVC pastes with varying viscosities,
- lower delamination tendency at PVC gelling phase due to capillary structure holding the plastisol in the structure,
- the optical properties of the end product are improved,
- dimensional stability is improved, and
- the production speed in the PVC coating may be increased, as the less PVC paste is used the more quickly it dries and fuses.

(0011) These and other objects of the present invention will become apparent to the person of ordinary skill in the art upon reading of the following specification and the claims appended hereto.

SUMMARY OF THE INVENTION

(0012) In accordance with the foregoing objectives, the present invention provides a method of manufacturing a carrier substrate for PVC flooring, a carrier substrate and

PVC flooring utilizing said carrier substrate. The carrier substrate is basically manufactured in the manner described already above. However, after the introduction of the binder and curing the binder, the thus formed substrate is coated on one side thereof with a pigment paste, which acts as a kind of a barrier layer, too. The pigment coating makes the surface smooth, gives the surface a higher brightness, and prevents, at least for the most part the penetration or permeation of the PVC paste in the later manufacturing stages of the PVC flooring.

BRIEF DESCRIPTION OF THE DRAWING

(0013) In the following the present invention is explained in more detail in reference to the accompanying drawing, which illustrates schematically a preferred embodiment of the carrier substrate of the present invention used in PVC flooring.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(0014) The carrier substrate used in the present invention may be manufactured, for instance, by a so-called wet-laid process where the glass fiber web is manufactured in a comparable manner as paper is manufactured with a paper machine. Other applicable processes are the so-called foam laid or dry-laid processes. Thus the fibrous suspension is introduced from a headbox onto a wire where the liquid from the suspension is removed through the wire by means of mere gravity draining or of specific suction boxes. After the web has reached the desired dryness binder in the form of a liquid is introduced into the web. The web saturated with the binder is taken to an oven to be dried and cured. This far the process is the same as a prior art method of manufacture, whereby the above should be taken as an exemplary option for the manufacture of the carrier substrate.

(0015) The novel part of the process includes the coating of one of the faces of the dried and cured substrate with a pigment paste. The pigment paste is applied onto the web by means of conventional techniques such as; for example spraying, film transfer coating, roller coating, curtain coating, or the like. After coating with the pigment the web is again dried in drying means and rolled. The rolls, slit to desired dimensions, are then delivered directly to the customers who produce the PVC floorings.

(0016) The coating pigment paste comprises at least one binder, either thermoplastic or thermoset, which is preferably a latex, like for instance, a polymeric latex binder, which is preferably composed of different acrylic esters or a co- or terpolymer of vinyl

acetate, ethylene and/or acrylics, e.g. ethylvinyl acetate (EVA-latex) and styrene acrylic latex. The binder may also consist of a thermoset polymer, which is preferably a polycarboxy polymer. The polycarboxy polymer used in the binder may comprise an organic polymer or oligomer containing more than one pendant carboxy group. The polycarboxy polymer may be a homopolymer or copolymer prepared from a variety of well-known low molecular weight unsaturated polycarboxylates including e.g. acrylic-maleic and acrylic-methacrylic acids or unsaturated anhydrides or their combinations.

(0017) The polycarboxy polymer may additionally comprise a copolymer of one or more of the aforementioned unsaturated carboxylic acids or anhydrides and one or more vinyl compounds. Methods for preparing these copolymers are well-known in the art.

(0018) The curable aqueous binder composition may also contain a polyol containing at least two hydroxyl groups. The polyol can be industrially processed synthetic polyol such as triethanolamine, or from natural sources such as hydrolyzed fats and oils, reduced sugars and carbohydrates e.g. glycerine and mannitol.

(0019) Also other binders or derivatives of such as polyvinyl alcohol (PVA), starch, styrene-butadiene rubber or combinations of different binders may be used. Thus the binders may, in general, be either synthetic or of natural origin or a combination of both.

(0020) The paste further contains mineral pigments, of which at least clay (normally bentonite or kaolin), calcium carbonate, titanium dioxide, gypsum, vermiculite, perlite, volcanic ash and talcum may be mentioned. Naturally, synthetic and coloured pigments are also applicable. The particle size of the filler material is usually about 5 μm or less. The pigment paste contains at least 30 weight percent, preferably 60 – 90 percent on dry basis, filler material.

(0021) Among other substances used in the paste, a variety of additives for instance, surfactants, dispersing agents, preservatives/fungicides, defoamers/antifoamers, pH adjustment chemicals, optical brighteners, etc. may be used. In some applications agents giving hydrophobic properties to the coating are added in the paste. Also rheology modifiers for the adjustment of viscosity, selected, for instance, from the known group of acrylic thickeners, polyurethane thickeners or cellulose thickeners, etc. may be used.

(0022) The paste may further contain cross-linkers, which are agents that are reactive with certain functional groups located primarily on the polymeric latex. Cross-linkers preferably are used in a concentration of 3 to 12 percent on a dry basis to improve important characteristics such as film formation, surface energy, wet strength etc.

5 These reactive agents can be either organic or inorganic types, e.g. based on zirconium, urea/formaldehyde, melamine/formaldehyde or glyoxal derivatives.

(0023) The use of the above-discussed coating paste makes it possible to use a thinner carrier substrate. In the performed tests the prior art glass fiber substrate having the basis weight of about 60 g/m² could be replaced with a glass fiber

10 substrate having the basis weight of 35 g/m² provided with the pigment coating of the invention. In such a case the pigment coating of the present invention may be from 2 to 150 g/m², preferably 2 – 50 g/m². However, depending on the exact application and the coating method the basis weight of the coating may be raised even up to 150 – 200 g/m². Additionally, it is possible to use finer fiber material than before. The

15 practical examples show that fiber diameter may be reduced to below 20 microns, preferably down to 8 – 15 microns. Normally the back layer of a flooring product is formed of substantially thick PVC foam. For some end uses, the back layer may be left out and replaced with a pigment coating of the present invention coated on the back face of the substrate.

(0024) Normally, the present invention makes it possible to use glass fiber substrates having a basis weight below 50 g/m² together with a coating having a basis weight from 2 to 50 g/m². An advantageous feature concerning the coating of the invention is found after the impregnation of the coated glass fiber substrate. When the substrate is coated with the pigment paste, and the pigment paste is dried on one face of the

25 substrate, the pigment layer is smooth i.e. it hides the ends of the fibers, thereby giving a finished look to the product. Depending on the thickness of the pigment layer there may be left small openings in the layer. Thus, the pigment coating does not form a totally closed surface, but such a barrier layer that prevents the free flow of PVC paste therethrough. In other words, the opening size in the pigment layer is smaller

30 than the open cavities in the basic glass fibre substrate. Now that the glass fiber material is substantially fine i.e. 8 to 15 microns, and the pigment coating is substantially thin, it has been learned that both the glass fiber substrate, and the coating include small pores, which draw due to capillary action the impregnation paste. Thus the impregnation paste not only impregnates the glass fiber layer, but

35 also the coating layer whereby the structure of the substrate after impregnation is

much more uniform than using the prior art techniques. Since the final impregnation of the paste takes place by capillary action, the impregnation paste does not enter to the open surface of the pigment layer but remains within the pores. A further advantage may be found in that the thinner coating layer is much more flexible than the thicker prior art layers, and its resistance to liquid penetration is superior to the prior art layers.

(0025) In case a more efficient closing of the substrate is desired it is possible to add, for instance with the above described coating, such plastisol reactive substance/substances that, when getting into contact with plastisol, swell and fill the pores of the felt even more efficiently. In other words, since the pigment paste is introduced as a suspension in water, along with it may be introduced substances that are reactive with the organic solvents of the PVC paste. Thus the swelling is activated simultaneously with the introduction of the PVC impregnation paste.

(0026) The appended figure shows the carrier substrate of the invention used in a CV flooring. The CV flooring utilizing the carrier substrate of the present invention comprises in the mid part thereof the glass fiber carrier substrate 20a provided with the pigment coating 22 of the present invention. The actual production of the PVC flooring of this embodiment comprises several steps including

- a) Impregnating the glass fiber carrier substrate 20a with the impregnation paste 20b, preferably a PVC plastisol paste,
- b) Coating the substrate 20a with a second paste 24, on which the desired printing 26 is made. This is the so-called foam core.
- c) Laying the bottom layer 30 on the pigment coating 22 of the present invention. The bottom layer is most often so-called back foam, which gives the product the cushioning properties it requires, and
- d) Laying the top layer 28, which is a specially designed wear layer.

(0027) It should be understood that the order of laying the different layers in steps b) and d) or c) and d) depends on the manufacturer. I.e. most of the manufacturers prepare the foam core after impregnation, then after the printing the bottom layer and wear layer as the last step, whereas sometimes it is possible to prepare the layers in different order. The back layer may also be a compact PVC layer without cushioning properties.

(0028) While the invention has been described with preferred embodiments, it is to be understood that variations and modifications may be resorted to as will be apparent to those skilled in the art. Such variations and modifications are to be considered within the purview and the scope of the claims appended hereto.

CLAIMS

1. Method of manufacturing a carrier substrate for a CV-flooring, comprising the steps of
 - (a) Laying a glass fibre substrate on a surface,
 - 5 (b) Introducing binder material into the substrate,
 - (c) Curing the binder to form a glass fiber felt,
 - (d) Introducing pigment paste on one face of the glass fibre felt to form a pigment coating, and
 - 10 (e) Drying the pigment coating layer to form a barrier layer for preventing the penetration of impregnation paste through the carrier substrate during the CV-flooring manufacture, whereby the steps (a) through (e) are performed in-line i.e. as a continuous process.
- 15 2. Method as recited in claim 1, characterized in that said pigment paste is introduced on said glass fibre felt by means of one of spraying, film transfer coating, roller coating, and curtain coating.
- 20 3. Method as recited in any of the preceding claims, characterized in that said pigment paste contains at least a binder and a pigment.
- 25 4. Method as recited in any of the preceding claims, characterized in that said binder is at least one of EVA-latex, acrylic latex, styrene-acrylic latex, polycarboxy polymer, styrene-butadiene rubber, polyvinyl alcohol (PVA), and starch.
- 30 5. Method as recited in any of the preceding claims, characterized in that said polycarboxy polymer is at least one of acrylic acid, methacrylic acid, crotonic acid, maleic acid, and cinnamic acid.
- 35 6. Method as recited in any of the preceding claims, characterized in that said pigment is composed of at least one of clay, kaolin, bentonite, calcium carbonate, titanium dioxide, talcum, vermiculite, perlite, volcanic ash, gypsum, and synthetic pigments.
7. Method as recited in any of the preceding claims, characterized in that said pigment paste contains at least 30 weight percent filler material.

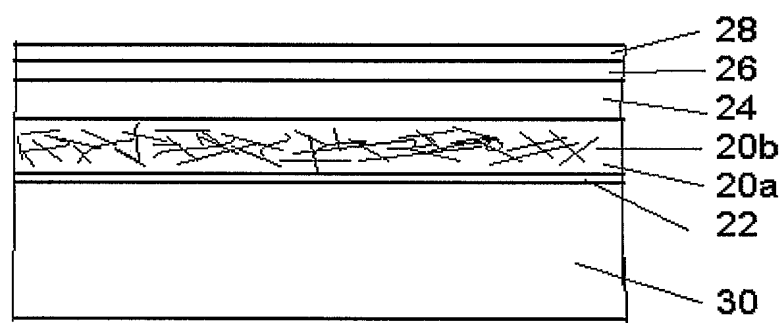
8. Method as recited in any of the preceding claims, characterized in that said pigment paste contains 60 - 90 weight percent filler material.
- 5 9. Method as recited in any of the preceding claims, characterized in that, in step (d), adding plastisol reactive substance/substances into the glass fibre substrate.
- 10 10. A carrier substrate for a CV-flooring manufactured in accordance with any of the preceding claims, said carrier substrate containing a fibrous substrate (20a) of mainly glass fiber in the form of a felt, where binder is used to bind the fibers together, characterized in a pigment coating (22) coated on one face of said glass fiber mat (20a) for preventing the penetration of impregnation paste through the carrier substrate during the CV-flooring manufacture.
- 15 11. The carrier substrate as recited in claim 10, characterized in that said pigment coating (22) is composed of at least a binder, and a pigment.
- 20 12. The carrier substrate as recited in any of claims 10 and 11, characterized in that said binder is either synthetic or of natural origin or a combination of both.
- 25 13. The carrier substrate as recited in any of claims 10 - 12, characterized in that said binder is at least one of EVA-latex, acrylic latex, styrene-acrylic latex, polycarboxy polymer, styrene-butadiene rubber, polyvinyl alcohol (PVA), and starch.
14. The carrier substrate as recited in any of claims 10 - 13, characterized in that said polycarboxy polymer is at least one of acrylic acid, methacrylic acid, crotonic acid, maleic acid, and cinnamic acid.
- 30 15. The carrier substrate as recited in any of claims 10 - 14, characterized in that said pigment is composed of at least one of clay, kaolin, bentonite, calcium carbonate, titanium dioxide, talcum, vermiculite, perlite, volcanic ash, gypsum, and synthetic pigments.

- 5 16. The carrier substrate as recited in any of claims 10 - 15, characterized in that said pigment coating contains at least one of pigments, pH adjustment chemicals, hydrophobic agents, rheology modifiers, crosslinking chemicals, surfactants, dispersing agents, preservatives/fungicides, defoamers/antifoamers, and optical brighteners.
17. The carrier substrate as recited in any of claims 10 - 16, characterized in that said pigment paste contains at least 30 weight percent filler material.
- 10 18. The carrier substrate as recited in any of claims 10 - 17, characterized in that said pigment paste contains 60 - 90 weight percent filler material.
- 15 19. The carrier substrate as recited in any of claims 10 - 18, characterized in that the glass fibre felt has a basis weight of less than 50 g/m².
- 20 20. The carrier substrate as recited in any of claims 10 - 19, characterized in that the pigment layer has a basis weight of 2 - 150 g/m², preferably 2 - 50 g/m².
21. Use of a glass fiber substrate in accordance with any of the claims 10 through 20 and manufactured in accordance with any of the claims 1 through 9 in the form of a felt (20a), where binder is used to bind the fibers together, and a pigment coating (22) coated on one face of said glass fiber felt (20a) as a carrier layer for a CV-flooring.
- 25 22. CV-flooring, which is formed of at least a glass fibre carrier layer (20a, 20b), a foam core (24), a wear layer (28), and a bottom layer (30), characterized in a pigment layer (22) arranged between said carrier layer (20a) and said bottom layer (30).
- 30 23. CV-flooring, which is formed of at least a glass fibre carrier layer (20a, 20b), a foam core (24), and a wear layer (28), characterized in a pigment layer (22) coated on the opposite face of said carrier layer (20a), said pigment coating (22) remaining as the bottom layer of the final product.

24. CV-flooring, which is formed of at least a glass fibre carrier layer (20a, 20b), a foam core (24), a printing layer (26) and a wear layer (28), said printing layer (26) and said wear layer (28) being arranged one on top of the other on one face of said carrier layer (20a, 20b), characterized in a pigment coating (22) coated on the opposite face of said carrier layer (20a), said pigment coating (22) remaining as the bottom layer of the final product.

25. The carrier substrate as recited in any of claims 22 - 24, characterized in that the glass fibre carrier layer (20a) has a basis weight of less than 50 g/m².

26. The carrier substrate as recited in any of claims 22 - 25, characterized in that the pigment coating (22) has a basis weight of 2 - 150 g/m², preferably 2 - 50 g/m².



Fig

INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. D06N7/00 D06N3/06 D04H1/58 D21H19/36

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06N D04H D21H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 138 521 A (BROWN ET AL) 6 February 1979 (1979-02-06) column 1, line 66 - column 2, line 31; claims 1,4,6,8,10,12; figures column 3, line 26 - column 4, line 15 column 4, last paragraph - column 5, line 43 column 6, line 3 - line 16	10-26
X	US 2003/175478 A1 (LECLERCQ CLAUDE) 18 September 2003 (2003-09-18) page 2, paragraph 32 - paragraph 47; claim 24 page 3, paragraph 62 - paragraph 65 ----- -/--	1-18

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Pamies Ollé, S

INTERNATIONAL SEARCH REPORT

International application No

PCT/FI2006/050065

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 175 155 A (BIRANOWSKI, JEROME ET AL) 20 November 1979 (1979-11-20) column 2, line 7 - line 32; claims 1,2; example I column 5, line 65 - column 6, line 12 column 7, line 13 - line 15 -----	10-21
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